

What is claimed is:

- 1 1. An imager module with a retractable lens comprising:
 - 2 a lens holder having
 - 3 an image end and an
 - 4 object end and
 - 5 an inner guide surface, parallel to
 - 6 an optical axis,
 - 7 an imager having
 - 8 an image plane, the imager being coupled to the lens holder adjacent the
 - 9 lens holder image end and aligned to position the image plane to be normal to the
 - 10 optical axis,
 - 11 a lens assembly having
 - 12 an object end, and
 - 13 an image end,
 - 14 an external guide surface,
 - 15 the lens assembly being coupled to the lens holder by the lens holder inner guide
 - 16 surface being coupled to the lens assembly external guide surface, the lens holder being
 - 17 formed to allow the lens assembly external guide surface to move on the lens holder
 - 18 inner guide surface from a retracted position to an extended position,
 - 19 an objective lens with one or more lens elements concentrically aligned
 - 20 along and normal to the optical axis; and,
 - 21 a means for extending the lens assembly and for holding the lens assembly in the
 - 22 extended position for an imaging interval during which the objective lens captures an
 - 23 object image, forms the object image on the image plane allowing the imager to capture
 - 24 and store the image in response to a command signal.
- 1 2. The imaging module of claim 1 wherein the lens assembly further comprises:
 - 2 a lens barrel, having a cylindrical external surface shape, the lens barrel holding
 - 3 at least the objective lens first lens element centered on the optical axis to form the
 - 4 objective lens, the external guide surface being formed on a lens barrel external surface
 - 5 for engagement with the lens holder inner guide surface.

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1 3. The imaging module of claim 1 wherein
2 the lens holder inner guide surface is formed having a forward surface portion
3 and a rear surface portion, an object end aperture at the object end providing entrance to
4 a first cylinder, the inner wall of the first cylinder forming the forward surface portion
5 of the inner guide surface, the lens holder optical axis passing through the center of the
6 first cylinder, the first cylinder having a first diameter, the first cylinder extending
7 rearward to a first circular aperture bordered by a first shoulder surface, the first
8 shoulder surface extending outward to a second cylinder having a diameter larger than
9 the diameter of the first cylinder, the inner wall of the second cylinder forming the
10 forward rear surface portion of the inner guide surface, the second cylinder extending
11 to a second circular aperture bordered by a second shoulder surface, the second shoulder
12 extending outward to a third cylinder having a diameter larger than the diameter of the
13 second cylinder, the third cylinder extending rearward to a third circular aperture at the
14 image end of the lens holder, the first, second and third cylinders being coaxial on the
15 optical axis,
16 the lens assembly has a lens barrel, the lens barrel has an object end and an
17 image end and a cylindrical surface, the cylindrical surface has a forward portion at the
18 object end and a rear portion at the image end, the forward and rear portions form the
19 external guide surface, the forward portion has a diameter formed to fit into the lens
20 holder first cylinder, the rear portion forms a cylindrical flange and has a diameter
21 formed to fit into the lens holder second cylinder and to telescopically slide within the
22 second cylinder, the lens barrel forward portion is free to telescope out of the lens
23 holder object end and to extend to a travel stop as the cylindrical flange contacting the
24 lens holder first shoulder surface.
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1 4. The imaging module of claim 3 wherein the lens barrel forward portion further
2 comprises an outer barrel having an outer cylindrical surface that forms the lens
3 assembly external guide surface, and an inner lens barrel within the outer barrel, the
4 inner barrel is coupled to support and locate the one or more lens elements forming the
5 objective lens, the outer barrel and the inner barrel are coupled together at a flexure
6 formed between the outer barrel and the inner barrel, the flexure being characterized to
7 hold a portion of the outer barrel outer surface in contact with the lens holder inner
8 guide surface.
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1 5. The imaging module of claim 4 wherein the imaging module further comprises:
2 a spring having an object end coupled to the lens barrel image end and an image end
3 coupled to the lens holder, the spring is contained in the lens holder second cylinder,
4 the spring expands to apply a force to the image end of the lens assembly flange driving
5 the lens assembly to an extended state.

1 6. The imaging module of claim 4 wherein the flexible outer barrel outer
2 cylindrical surface is further characterized to have a protrusion adjacent the flexible
3 outer barrel, and the lens holder inner surface is further characterized to have a recess
4 formed to receive the protrusion as the lens assembly is forced into a retracted state, the
5 lens holder first and second cylinders receiving the lens assembly, the spring being
6 compressed in the lens holder second cylinder as the lens assembly is moved into a
7 retracted position.
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1 7. The imaging module of claim 4 wherein the lens assembly outer barrel
2 is magnetized have:
3 an object end magnetic pole having a first magnetic polarity and an image end magnetic
4 pole having a second magnetic polarity, and wherein:
5 the lens holder has an external surface, the lens holder having a coil coupled to
6 the lens holder external surface for forming an electromagnetic field in at least the lens

7 holder first or second cylinder in response to an electrical command signal, the polarity
8 of the electromagnetic field and the polarity of the image end magnet pole and the
9 object end magnetic pole being ordered to produce a force to move the lens assembly to
10 a fully extended position.

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1 8. The imaging module of claim 1 wherein the lens assembly barrel has an object
2 end magnetized to form an object end magnet pole having a first magnetic polarity and
3 an image end magnetic pole having a second magnetic polarity,
4 the lens holder having an external surface,
5 a coil means coupled to the lens holder external surface for forming an
6 electromagnetic field in the lens holder first cylindrical aperture in response to an
7 electrical signal, the polarity of the electromagnetic field and the polarity of the image
8 end magnet and the object end magnet being ordered to produce a force to move the
9 lens assembly to a fully extended position.

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1 9. The imaging module of claim 1 wherein the means for extending the lens
2 assembly and for holding the lens assembly in the extended position for an imaging
3 interval further comprises:
4 a lens barrel outer surface having a permanent magnet coupled to its surface,
5 a non-fero-magnetic ring axially positioned on a circular lens holder outer
6 surface and free to rotate, the ring having at least two permanent magnets to be coupled
7 to the ring on opposing radials to permit the polarity of the magnetic pole applied to
8 permit the magnet in the lens barrel to be reversed by rotation of the ring.

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1 10. The imaging module of claim 1 wherein the means for advancing the lens
2 assembly to the extended position in response to an extend signal is provided by a
3 compressed spring having an object end pressing to the lens barrel image end and an
4 image end coupled to the lens holder, the spring is contained in the lens holder second
5 cylinder, the spring expanding to apply a force to the image end of the lens barrel
6 flange to drive the lens assembly to an extended state, and wherein the means for
7 retracting the lens assembly to a retracted position is a manually applied force to the
8 lens barrel to drive the lens barrel into the lens holder first and second cylinders.

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1 11. The imaging module of claim 1 wherein the means for advancing the lens
2 assembly to the extended position in response to an extend signal and for retracting the
3 lens assembly to a retracted position is a permanent magnet combination.

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1 12 The imaging module of claim 1 wherein the means for extending the lens
2 assembly and for holding the lens assembly in the extended position for an imaging
3 interval during which the objective lens captures an object image, forms the object
4 image on the image plane allowing the imager to capture and store the image in
5 response to a command signal further comprises:

6 a coil on the lens holder coupled to a signal source to receive a pulse of current
7 having a first polarity from the signal source, the current in the coil producing a
8 magnetic field in the lens holder first and second cylinders, the lens assembly having

9 a lens barrel having a cylindrical external surface shape, the lens barrel having a
10 permanent magnet formed therein, the permanent magnet being orientated to be
11 repulsed by the magnetic field having a first polarity to drive the lens assembly to an
12 extended position.

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13 The imaging module of claim 1 wherein the means for advancing the lens assembly to the extended position in response to an extend signal and for retracting the lens assembly to a retracted position in response to a retract signal is an electromagnetic-magnetic means and further comprises:

a coil on the lens holder connected in series with a coil on the lens assembly (outer barrel) responsive to a signal source responsive to an extend signal and a retract signal for providing the direction of a pulse current through the coil on the lens holder and the lens assembly.

1 14 An imager module with a retractable lens comprising:
2 a lens holder having
3 an image end and an
4 object end and
5 an inner guide surface, parallel to
6 an optical axis,
7 an imager having
8 an image plane, the imager being coupled to the lens holder adjacent the
9 lens holder image end and aligned to position the image plane to be normal to the
10 optical axis,
11 a lens assembly having
12 an object end, and
13 an image end,
14 an external guide surface,
15 a lens barrel having an external guide surface,
16 the lens assembly being coupled to the lens holder by the lens holder inner guide
17 surface being coupled to the lens assembly external guide surface, the lens holder being
18 formed to allow the lens assembly external guide surface to move on the lens holder
19 inner guide surface from a retracted position to an extended position,
20 an objective lens with one or more lens elements concentrically aligned
21 along and normal to the optical axis; and,

22 a coil on the lens assembly and a coil on the lens holder outer surface. the coils
23 being connected in series to provide a repulsive force to drive the lens barrel to an
24 extended state in response to an extend signal and to a retracted state in response to a
25 retract signal.

1 15. A handheld device having an extendable imager, the extendable imager
2 comprising:
3 a lens holder having
4 an image end and
5 an object end and
6 an inner guide surface,
7 an imager having an image plane, the imager being coupled to the lens holder adjacent
8 the lens holder image end,
9 a lens assembly having an objective lens with one or more lens elements and an
10 optical axis, the lens assembly having
11 a lens barrel holding at least one lens,
12 an image end,
13 an object end,
14 an optical axis and
15 an external guide surface, the lens assembly external guide surface being
16 supported by the lens holder inner guide surface, the lens holder being formed to allow
17 the lens assembly external guide surface to move on the lens holder inner guide surface
18 from a retracted position or latched position to an extended or unlatched position,
19 a means for advancing the lens assembly to the extended position in response to
20 an extend signal.

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1 16. The handheld device of claim 15 wherein the means for advancing the lens
2 assembly to the extended position in response to an extend signal comprises:
3 a lens barrel having at least one permanent magnet embedded therein,
4 a ring positioned and formed to rotate on the lens holder, the ring having at least
5 one magnet embedded therein, the magnet in the barrel and the magnet in the ring
6 providing a field to drive the lens barrel into an extended mode in response to the ring
7 being rotated to have the field of the magnet embedded in the ring repulse the field
8 provided by the magnet in the lens barrel.
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